concrete construction

MARCH 1958 **VOL. 3, NO. 3**

EDITED FOR All who are concerned with quality, JOB PLACED CONCRETE (including prestress, tilt-up, lift slab, and thin-shell)—its production, handling, forming, reinforcing, placing, finishing, and curing: CONCRETE CONTRACTORS; GENERAL CONTRACTORS; INDUSTRIAL CONSTRUCTION AND MAINTENANCE MEN; ENGINEERS; ARCHITECTS; STATE HIGHWAY ENGINEERS; READY-MIXED CONCRETE PRODUCTS.

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FEATURES

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CONCRETE CONSTRUCTION MAGAZINE

139 No. Clark St. Chicago 2, Illinois

ANdover 3-4329

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books

Manual of Recommended Practice for Inspection and Testing of Concrete Materials and Concrete. *Published by Concrete Industry Board, Inc., 220 East 42nd Street, New York 17, New York. 12 pp. $0.50.*

This small volume may well prove to be a landmark in the Concrete Industry Board's long sustained program to improve the standards of concrete construction work. The document is the work of a joint committee of testing laboratories in the metropolitan New York area appointed by the Concrete Industry Board. It is based on the experience of the committee members and on practice and code requirements in the New York area. The committee has clearly and forthrightly stated certain principles which they believe should be followed in the inspection and testing of concrete and concrete materials. For example, it recommends that the owner or architect and not the contractor should employ a qualified testing laboratory to carry out the requirements of the specifications. It clearly enunciates the principle that as a professional service the laboratory should not be engaged on the basis of competitive bidding.

Section A of the manual covers such subjects as the preliminary test of materials and mix design, the duties of batch plant inspector and project site inspector, and covers in detail such matters as casting, protecting and storing concrete test cylinders on project sites as well as in the laboratory. Section B covers a discussion of controlled concrete versus average concrete, gives recommendations for the procedures to be followed in producing controlled concrete in the city of New York, and includes suggested specifications.

Design of Tilt-Up Buildings. *By F. Thomas Collins. Published by Know How Publications, P. O. Box 208, San Gabriel, California. 162 pp. Illus. $12.50 postpaid U. S. A.*

This is the third volume which Mr. Collins has written on the general subject of tilt-up construction, the first having carried the title "Manual of Tilt-Up Construction" and the second the title "Building with Tilt-Up." The preface points out that tilt-up construction has developed to the stage that the general understanding of its principles

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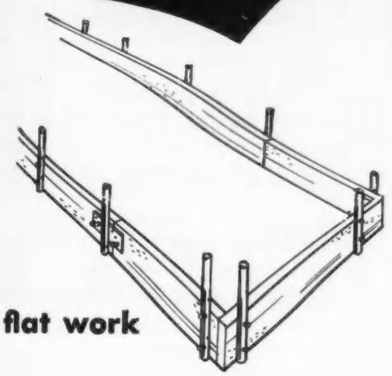
for the concrete contractor



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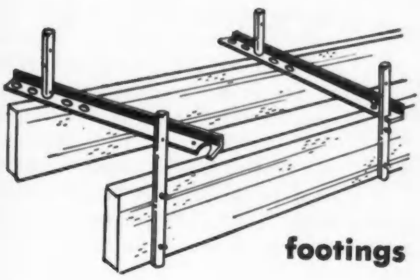

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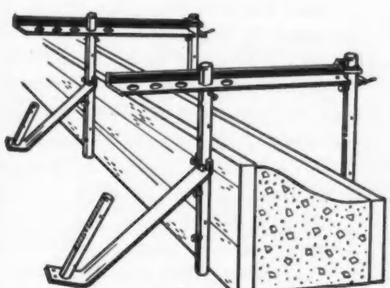

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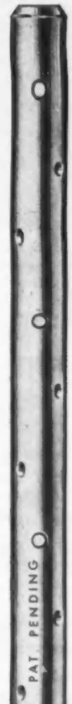

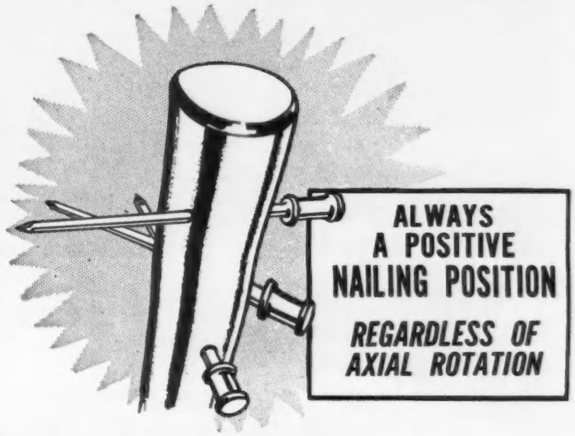

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books

and methods of design is in demand by design offices and individual engineers and architects throughout the country. The new book, which has been intentionally limited to industrial and commercial buildings, is intended to partially fulfill this demand, the emphasis being on one-story construction but with some two and three-story building being included.

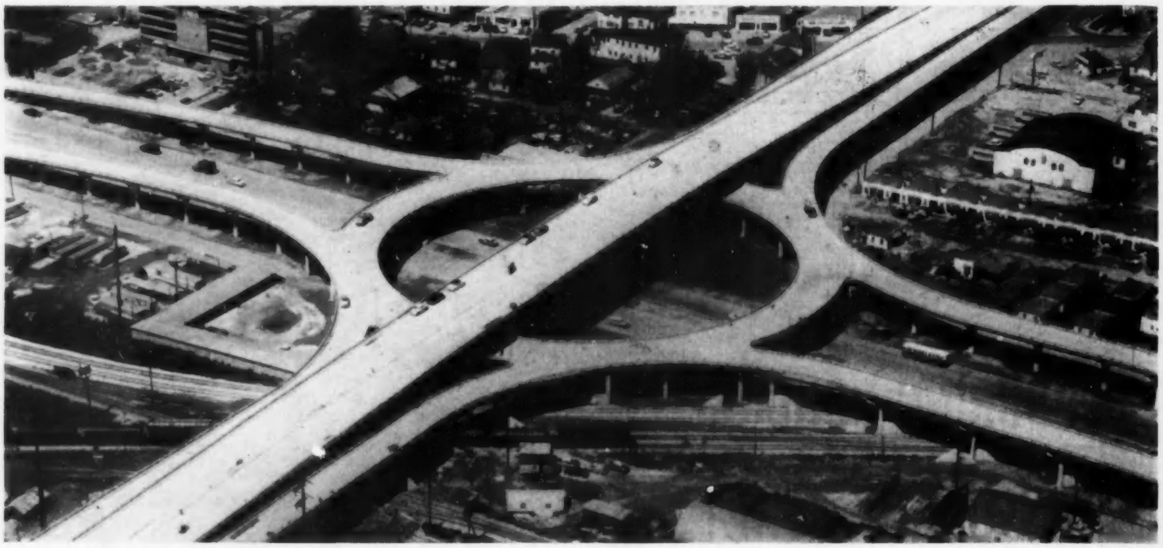
It is noted that at the present time 80 percent of the single-story industrial and commercial buildings in southern California are being constructed by the tilt-up method and that the buildings have been tested by fire, wind, earthquake, flood and blast forces. The author points out that the structural integrity of the method when properly designed has been proved beyond question, but he comments that there still remain problems of joinery, application of prestressing, design standards, code standards, and apprentice instruction.

The volume is generously illustrated with photographs, diagrams and charts, and numerous examples of design calculations are given to illuminate the various principles discussed. For those who are not familiar with field practice in connection with tilt-up, it would seem to be desirable to obtain a copy of the author's book "Building with Tilt-Up" for study along with the new volume.

Proceedings of the World Conference on Prestressed Concrete. *Published by World Conference on Prestressed Concrete, Inc., Room 216, 417 Market Street, San Francisco 5, California. 600 pp. Illus. $10.00.*

This is probably the most varied collection of know-how on the subject of prestressing ever assembled in a single volume. Part I covers the 38 papers which were presented orally at the Conference, while Part II presents an additional 26 papers which were prepared for the Conference but not delivered orally because of the crowded schedule.

The Conference brought together scientists, engineers and manufacturers in the field of prestressed concrete, with 1200 delegates from all over the world participating. The Proceedings were edited by J. W. Kelly, T. Y. Lin, A. C. Scordelis and C. C. Zollman.



AIRLINE HIGHWAY INTERCHANGE handles traffic from Airline Highway, a principal east-west route, and Causeway Blvd., the only direct north-south route in East Jefferson Parish (New Orleans). Built for the Greater New Orleans Expressway Commission. Engineering and design by Palmer and Baker Engineers, Inc., New Orleans. Louisiana Paving Co., Kenner, La., contractor.

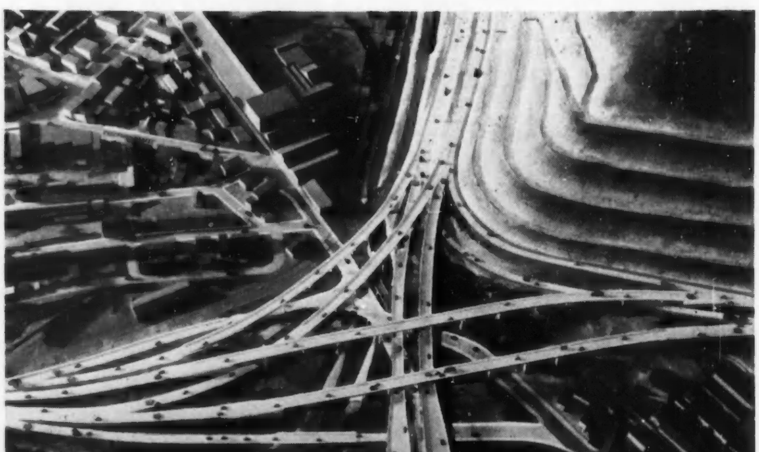
Go-Signs to Civic Progress — two unusual interchanges

NEW ORLEANS and Pittsburgh had the same problem. Converging highways caused progress-choking traffic jams. Each city found the solution in impressive interchanges. Two of their structures present an interesting contrast in design.

The New Orleans Airline Highway Interchange is a compact, symmetrical 4-level design, dominated by a unique elevated traffic circle. It consists of a 6-lane underpass, service roads at grade, intermediate level turning circle with 8 approach ramps, and a 4-lane overpass.

On the other hand, Pittsburgh's Etna Interchange, now under construction, is a seeming maze of roads and ramps. Several miles of roadways will crisscross at multiple levels. Construction problems are unusually tough. Steep hills must be benched out, railroad tracks relocated and even a stream bed shifted.

Modern traffic requires spectacular highway structures like these, and modern truck mixers to pour them. These highly mobile concrete plants can operate where other equipment can not be used. Their mixing efficiency is guaranteed by Rating Plate, certifying their correct design, capacity and mixing speed and accuracy of water control.



ETNA INTERCHANGE (shown in a model) will pick up traffic from downtown Pittsburgh, a main local artery and two important highway routes. Leonard J. Curran, engineer in charge for Pennsylvania Department of Highways. Richardson, Gordon and Assoc., Pittsburgh, consulting engineers; Latrobe Road Construction Co., Latrobe, Pa., contractor.

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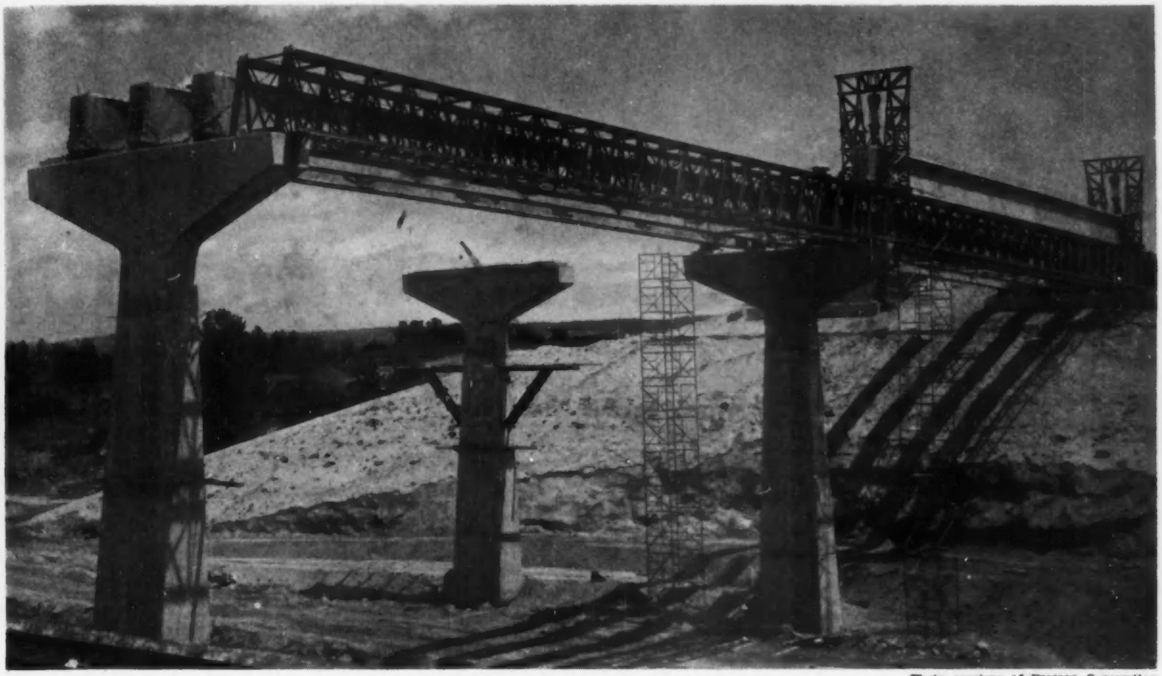


Photo courtesy of Prescon Corporation

Supporting the 96-ton load of one of the prestressed concrete girders for a bridge near Colorado Springs, Colorado the two gantry cranes at the far right of the picture are moving out on temporary steel trusses which span the distance between adjacent piers. Three of the girders are already in position.

Gantries Place Site Cast Prestressed Concrete Girders

WHEN A. S. HORNER CONSTRUCTION COMPANY, Denver, was awarded a contract recently for the construction of four highway bridges and two railroad bridges within the area of the Air Force Academy north of Colorado Springs, Colorado, it was confronted with a problem in positioning the prestressed concrete girders for the highway bridges following their onsite casting.

A total of 112 post-tensioned girders was employed in the highway bridges. Each girder weighed 96 tons, was 120 feet long and had an overall depth of 5 feet 11 inches. Eight girders, spaced on 9-foot centers, comprised each span of the 88-foot divided highway.

Two 60-ton cranes could have done the moving job, yet they were not readily available in the area. The use of four 30-ton cranes was considered, but this course of action was ruled out because of the roughness of the terrain.

Thus, the following method was developed: Two gantries were constructed, each with a 50-ton chain block. Mounted on rails which extended over the abutment on temporary steel trusses, these gantries, in effect, "straddled" each end of the girder in its casting bed. Subsequently, the gantry chain blocks were hooked onto the lifting loops in each end of the girder, which was then rolled into its final position in the span.

Concrete casting beds were constructed on one of the approaches to each bridge. These casting beds were aligned with the final location of the girders on the piers and abutments. Wooden side forms, fabricated in 20-foot long panels, were used to form the girders. These panels were bolted to inserts in the concrete form soffit at the base and tied across the top. Each panel was used an average of 15 times before major repair was needed. Both internal and external vibration were used for consolidation.

Each of the girders was fully prestressed and the tendons grouted before removal from the casting bed. The specified 28-day cylinder strength of the concrete was 5,500 psi, a cylinder strength of 4,500 psi being required at transfer. This strength was achieved in an average of four to five days with no special curing. The 2-inch average slump concrete produced an average 7-day strength of 6,345 psi. END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.

FRANK LLOYD WRIGHT'S GUGGENHEIM MUSEUM

He adds new dimensions to the use of poured concrete in building construction

BY GEORGE N. COHEN*

In our cover photograph Architect Frank Lloyd Wright and the author of our article are seen inspecting one of the four-foot diameter reinforced concrete columns in the Solomon R. Guggenheim Museum.

FILE: ARCHITECTURAL

ON FIFTH AVENUE, between 88th and 89th Streets in New York City, one of the most unusual concrete buildings ever constructed — the Solomon R. Guggenheim Museum — is nearing completion.

Featuring a spiral ramp making six turns at an approximate grade of 3 percent, stiffened by exterior webs at 30-degree intervals, and an inner court covered by a glass dome, this structure represents the great architect's conception of a natural facility for viewing modern art in a modern setting.

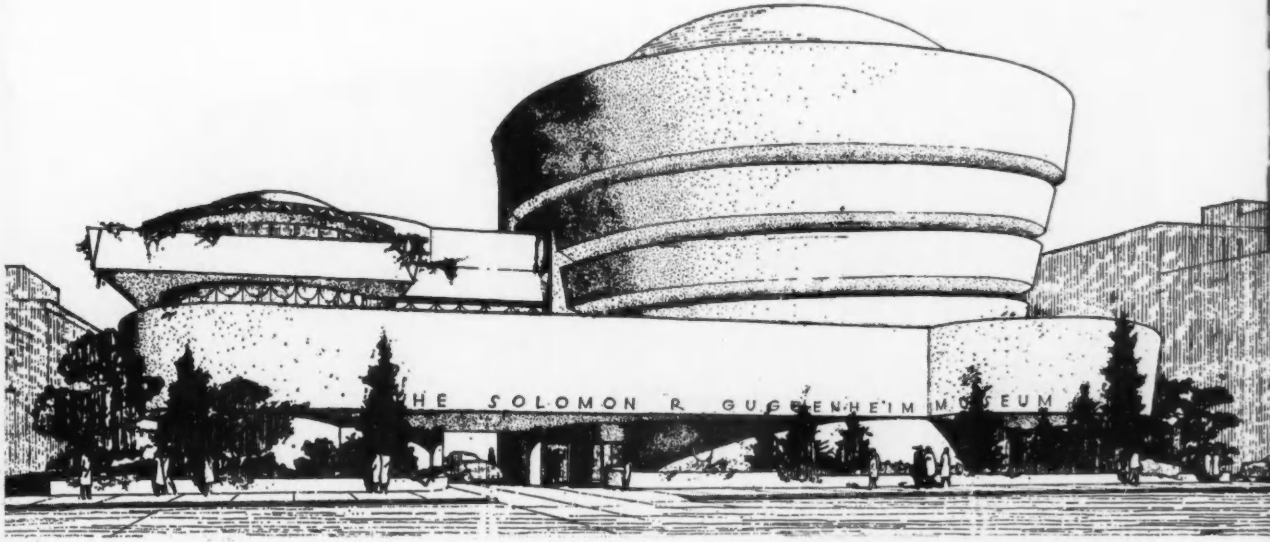
Reinforced concrete was used throughout, with lightweight "Lelite" aggregate for the superstructure. All concrete was designed for 3,500 psi and a plasticizing admixture was used throughout the project. Slump was kept at 3 to 4 inches. Expansion joints were carefully omitted. Control of concrete for uniform strength, the inherent shape of the structure, the arrangement of reinforcing, and the planned extent and location of pour sections, all contributed to the elimination of cracking, a quality so essential for architectural concrete.

*Mr. Cohen is president of Euclid Contracting Company, New York City, general contractor for the Guggenheim Museum.

The entire project actually incorporates three types of concrete. Lightweight expanded-shale concrete is used in the ramp and floors, while stone concrete (also of 3,500 psi strength) has been used for the interior walls to assure a smooth finish. The outer walls were formed by spraying 5 inches of concrete against curved plywood forms, this work being handled from the inside of the structure.

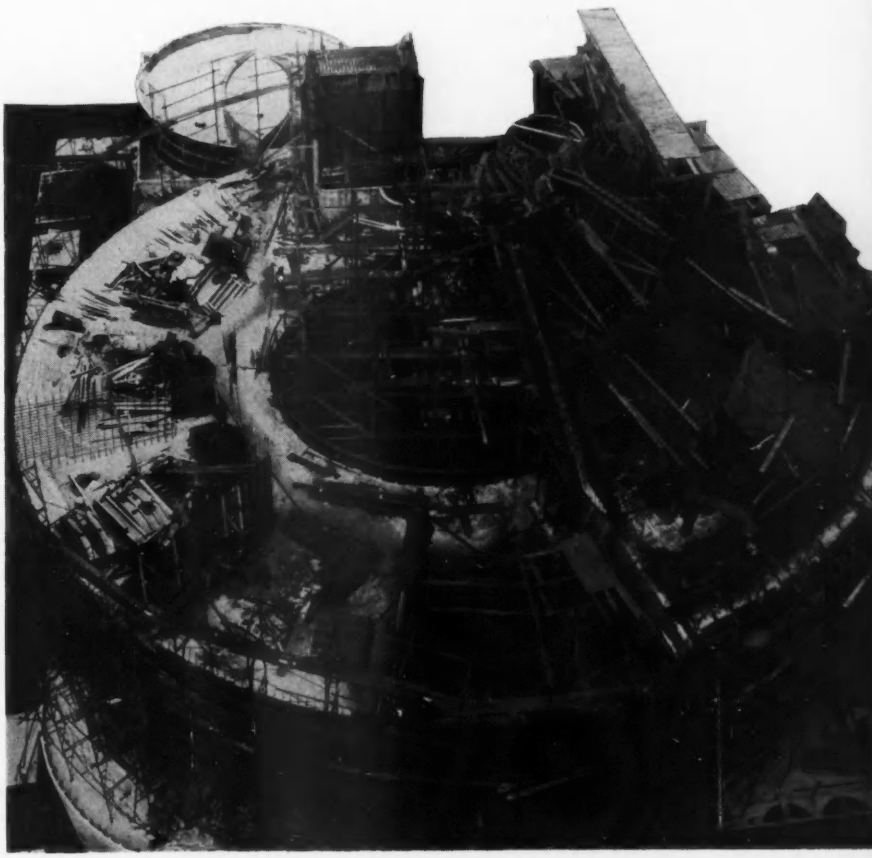
The foundation presented no unusual problems. Soft rock was conveniently encountered at levels not too far below the basement, and footings were carried to it. Old foundations were encountered and removed. These were massive masonry walls and piers deeply imbedded in virgin soil by the old master builders of the past century, who either had little conception of the strength of their materials, or were blissfully unconcerned with costs.

In view of the fact that the concrete structure was mostly exposed, both exterior and interior, and also in view of the fact that the shapes of the component parts were so unusual, great care had to be exercised in the design and erection of the formwork. Detailed dimensional drawings were prepared and used extensively. Isometrics and large scale templates were made to



The Solomon R. Guggenheim Museum as it will look when completed late this year. As nearly all-concrete as building construction can be, it abounds in some of the most daring and intricate poured-in-place cast concrete work ever attempted in this country.

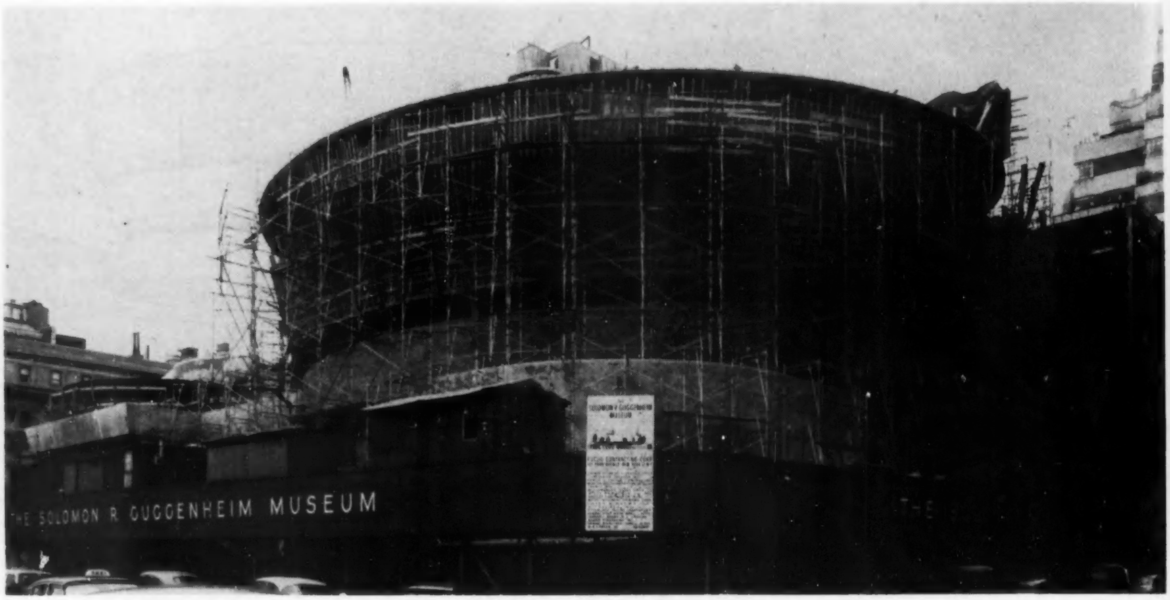
This photograph, taken from an upper story of an adjoining building, shows one of the upper levels of the ramp in the Museum wing in the foreground, and in the background at the left the roof of the 4-story circular administration wing.



elaborate and translate the intent of the architecture. Depending upon the radii and the shapes, varying thickness and types of plywood, prestwood and metal molds were used. Great care had to be taken in order to provide accurate and uniformly true lines, arises, and surfaces. An intricate mold in concrete is accentuated by good workmanship—and this was the premise throughout.

The structural design features rigid slabs with spans up to 60 feet and cantilevers up to 25 feet, some with highly concentrated end loading. The main ramp cantilevers 14 feet 6 inches to the inner court from a 13-inch deep rigid exterior beam of varying widths. Since the greater widths occur at the higher levels, the overall width of the ramp increases as it spirals upward.

The inside edge of the spiral ramp, which carries a 3-foot high plaster parapet, turns on a smaller and smaller radius as it rises upward. Similarly the outside edge which carries the gunite curtain wall turns on a greater and greater radius as it rises upward. The relationship between these constantly changing radii and the gradually rising plane of the ramp is so arranged that at any point in the height of the structure a horizontal plane will always



This view from street level shows the maze of scaffolding enclosing the circular Museum wing. The ramp makes six turns in all as it spirals up from the main floor to the top level.

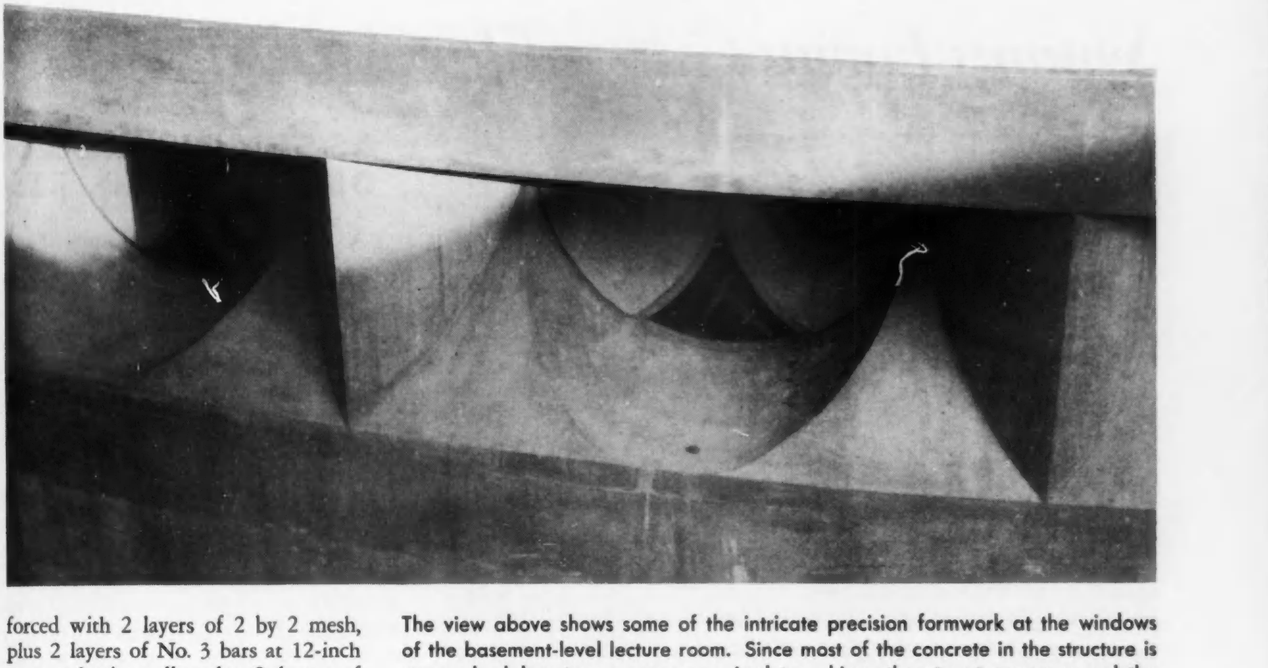
Here a portion of the ramp is shown with the reinforcing steel in place ready for pouring operations to begin. The structural slab of the ramp tapers in thickness from 13½ inches to 4½ inches. It is topped with a 2-inch terrazzo finish.

intersect a true circle. This is the result of a basic pattern of shapes. It is a conception of a large cone (whose apex is theoretically some 180 feet below datum zero) into which is fitted an inverted smaller cone whose apex is theoretically some 270 feet above datum zero.

To lay out this complex structure would ordinarily be extremely difficult, but the work was simplified by an overall grid system of 8-foot units. All lines, radial points and axes tied into this grid system in a precise pattern which gave the component parts of the structure an orderly natural scheme. All working points were tied by coordinates into the grid system, and for checking purposes the center point of the structure was physically carried up as the job progressed. The shop drawings and layout plans were accordingly superimposed upon this grid system.

Intricate and beautifully formed concrete members, becoming planting areas, fountains, utility cores, pipe spaces, oversize circular columns, arches and cantilevered balconies, blend smoothly into the whole structure as though they truly belong to it, which they do. Such is the genius of the great architect whose design is so clearly and naturally portrayed.

The outer walls generally consist of 5 inches of gunite shot from the inside against a carefully erected plywood form bent to the shape required —both circular and sloping. These gunite walls are rigidly connected to the ramp slab and web. They are rein-



forced with 2 layers of 2 by 2 mesh, plus 2 layers of No. 3 bars at 12-inch centers horizontally, plus 2 layers of No. 4 bars vertically, plus top and bottom continuous No. 4 bars—all secured to a framework of 1½-inch tees which are in turn tied into the structure. The inside surfaces of these walls are furred, lathed and plastered. The outside surfaces are smoothed after the forms are removed, but while the gunite is still green.

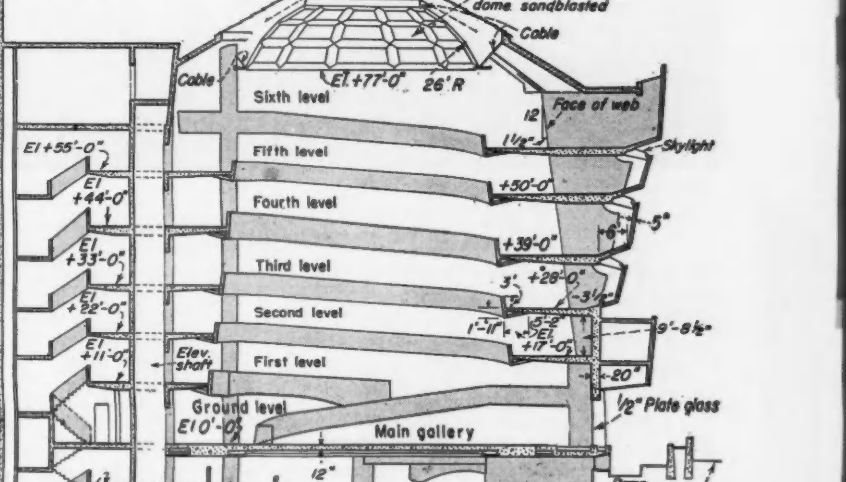
The facia of one of the roof parapets had been designed in sheet copper stamped to a geometric pattern. Due to the difficulty of stamping and erection, these sections were precast in concrete to the required pattern in faceted slabs. These slabs were then treated and sprayed with molten copper in the shop. They were then sent to the job, erected on centering and concrete poured to hold them in position.

The building is heated by means of radiant tubes located under the terrazzo finish of all floors. A 250-ton absorption machine utilizes steam heat and lithium bromide in a chemical process for the air conditioning system.

Although he has designed some 700 buildings in all, this is the first major project Frank Lloyd Wright has built in New York City. His representative on the job is William H. Short. The general contractor for the entire structure is Euclid Contracting Corporation of New York City. The work is being done under the direction of George N. Cohen, assisted by Joseph Neukrug. Charles W. Spero is job superintendent and project manager. END

The view above shows some of the intricate precision formwork at the windows of the basement-level lecture room. Since most of the concrete in the structure is exposed, elaborate care was exercised to achieve the utmost accuracy and the finest possible surface texture.

Cross sectional view of the Museum wing showing how the spiral ramp is employed to give access to the art displays along the outer wall at the right. At the first floor level the ramp has an inner radius of 32 feet and an outer radius of 48 feet, while at the fifth level the inner radius has decreased to 25 feet and the outer radius has increased to 57 feet. Starting at the main-gallery level, the ramp rises 11 feet with each complete revolution.



Symons Forms Ganged for Anchor Walls

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Modern forming methods answer the need of the jet age on the new TWA hangar at New York's International Airport. Symons 4 x 6 and 4 x 8 foot panels ganged in units 34 feet wide by 27½ feet were used for forming the 28 anchorage walls which strandle the full 80 foot roof width of the main building.

By using this method of forming, the contractor, Grove, Shepherd, Wilson & Kruge, Inc., poured the hangar in place at the cost of a precast structure. Panels were assembled on the ground at a cost of only 5¢ a square foot. It took about 15 minutes for a crane to tilt a gang form off the slab and inch it into place on the roof. 15,000 square feet of Symons wide panel forms were used in this gang forming operation. Symons wide panel forms have steel struts and 2 x 4 cross members to strengthen the panel and minimize deflection during pouring. Tie holes in the steel struts allow insertion and removal of special ties. Any strength tie may be used, including Williams removable end ties. Individual panels are built in 6' and 8' lengths and 30", 36" and 48" widths.

Project Manager, A. R. Maxwell, working closely with the local Symons forming engineer, devised this fast, efficient method of forming. This type service is available to all contractors, as well as the preparation from your plans, complete form layouts, bill of materials and recommendations for the best and least costly method of forming —there's no charge or obligation.

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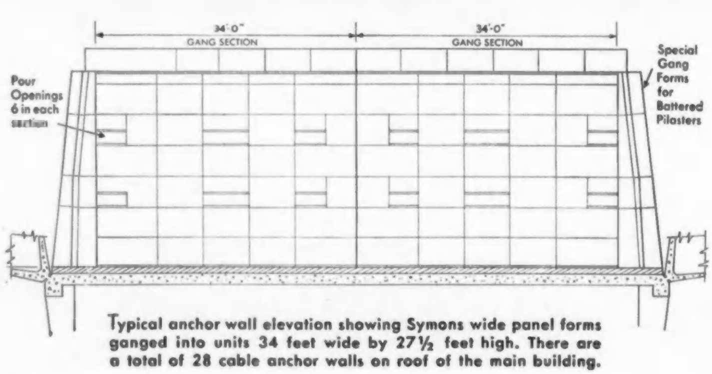

Typical anchor wall elevation showing Symons wide panel forms ganged into units 34 feet wide by 27½ feet high. There are a total of 28 cable anchor walls on roof of the main building.

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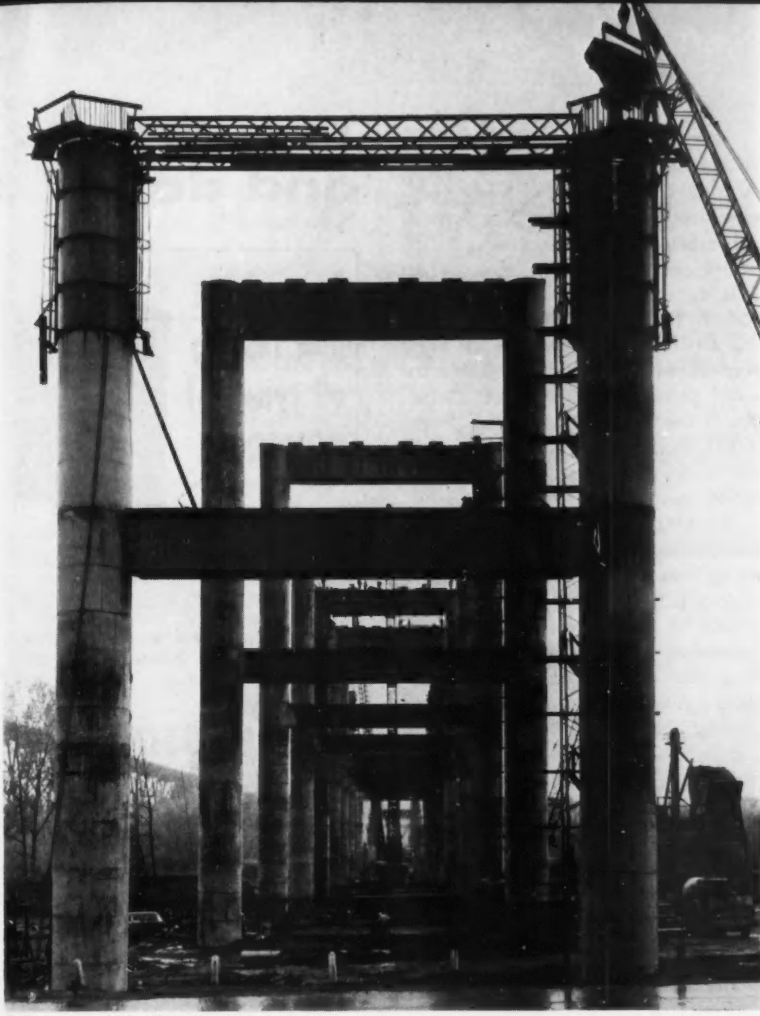


Photo courtesy of Blaw-Knox Company

The bent in the foreground of this view shows how the completed concrete columns are being utilized to support the weight of the formwork and the concrete as it is placed. The column forms are in place for pouring one of the lifts and the strut form is also in position below. Several finished pier bents are visible beyond the one under construction.

COMPLETED WORK CARRIES WEIGHT OF FORMS AND CONCRETE

A NEW IDEA IN STEEL FORM DESIGN now makes it possible to support over 300 tons of form and concrete high in the air without falsework. The load is carried on completed work.

These special forms are now being used by Johnson-Kiewit, joint venturers on the $6-million sub-structure contract for the new 4-lane high level bridge being constructed for the Berkshire section of the New York State Throughway.

The sub-structure consists of 42 pairs of circular concrete piers varying in diameter from 5 to 14½ feet. The pier bents are spaced 97 feet 6 inches apart with the exception of three central spans of 420, 600, and 420 feet which cross the river. Each pier, excepting five short ones near each end, is tied with an intermediate concrete strut at the 60-foot level and a pier cap.

To form the columns, which range

FILE: FORMING

Close-up showing one of the 20-foot lengths of column form in place after the concrete has been poured. Note that the base of the form rests on bolts which have been cast right into the column on the previous pour. The form is insulated to permit the contractor to work right on through the coldest winter weather.

in height to 135 feet, the contractor is using 320 lineal feet of 8-foot diameter steel column forms. These forms are fabricated in 5-foot lengths by 180-degree segments. Pouring 20-foot lifts, the contractor has sufficient forms to keep four sets of 8-foot piers working all the time. There are 40 lineal feet of 14½-foot circular forms for river piers and 20 feet of 14-foot forms for anchor piers. With some 7,000 lineal feet of columns to pour, the column "cans" will receive nearly 20 re-uses.

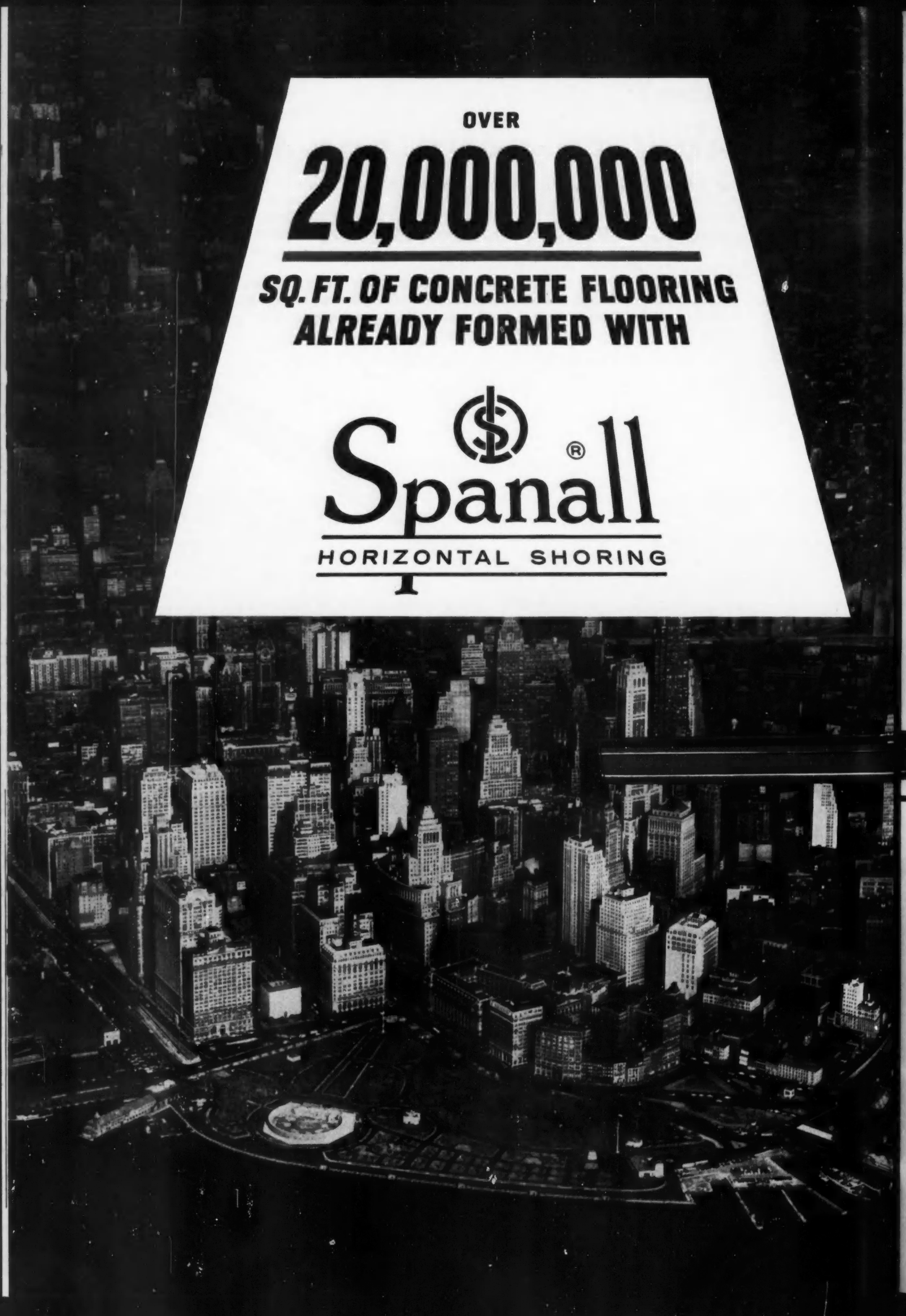
Working up from the foundation, the contractor uses a crane to handle his column form in full circular sections which consist of two 180-degree panels. A special truss, made by the contractor, is placed between piers to keep the distance uniform and the work plumb. Once the bolts which connect the column form halves are tightened, no further support is required.

As pours are completed the joint bolts are loosened and 20-foot lengths of the form are moved up. The base of the form rests on bolts which have been cast into the column on the previous pour.

In the two units which form a third of the column's surface, bearing blocks are integral parts of the form. The two blocks protrude 3 inches into the concrete when the pour is made. Anchor bolts 1½ inches in diameter are inserted through the blocks before the pour for additional support. The bearing blocks, which are left in place with the form panels to which they are attached when the strut pour is made, transmit the vertical shear to the columns. The anchor bolts absorb the resulting horizontal thrust.

With this arrangement on the 8-foot diameter columns the weight of the 12½-ton strut form and 65 cubic yards of concrete (a total of some 131 tons) is supported. Similarly, the 20½-ton pier cap forms and 118 cubic yards of concrete (or some 239 tons) are supported. END

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.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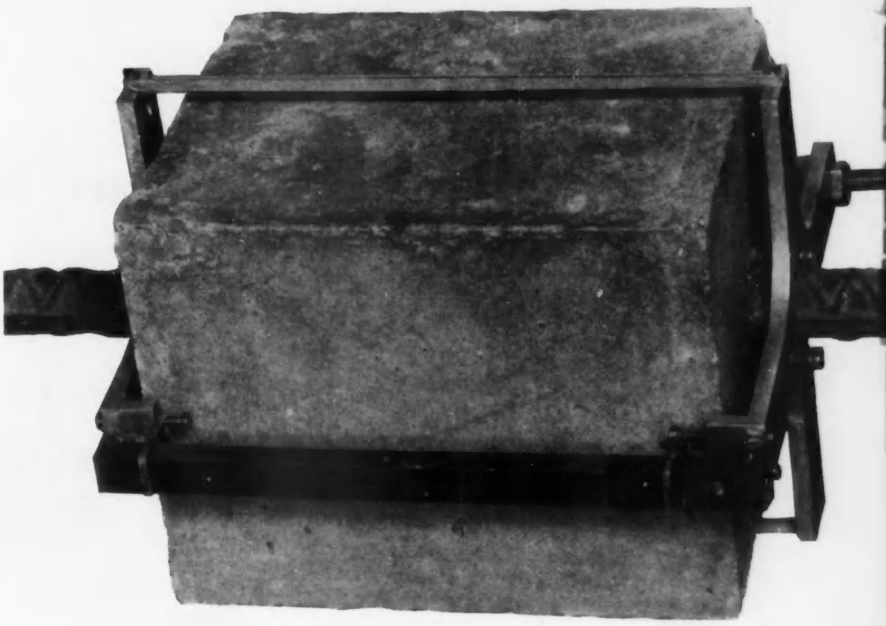
Scorbord is a black smooth-surfaced board of expanded polystyrene 1 inch thick, 2 feet wide and 8 feet long. Three striations cut the length of each board at the 3-, 12-, and 20-inch marks across its width permit the installer to snap off the widths desired, thus reducing work time up to 50 percent. Structural strength permits pouring of concrete slabs directly upon it. It is lightweight, waterproof, rot-proof, chemical resistant and has no food value for rodents or insects. **Dow Chemical Company, Midland, Michigan.**

Power Buggy

A 10-cubic foot capacity power buggy allows the operator either to walk behind or ride on a fold-down platform. It is a compact, lightweight model designed to travel over narrow runways, into elevators and through doorways as narrow as 31 inches. A positive-control dumping mechanism permits accurate placement of concrete. Speeds up to 5 mph are attainable. It is powered by a Wisconsin engine, and has front-wheel chain drive, automatic clutch and forward and reverse drive. **Whiteman Manufacturing Company, 13020 Pierce Street, Pacoima, California.**



View of a tensile bond specimen under test at the National Bureau of Standards. Indications are that the cracks that occur in concrete are narrower near the surface of the steel reinforcing bar than at outside surface of the concrete, thus exposing less steel to atmospheric corrosion than was previously believed to be the case.

WIDTH OF CRACKS IN REINFORCED CONCRETE

IN DESIGNING a reinforced concrete structure, the engineer takes into account the fact that cracks will eventually develop in the structure. These cracks expose the reinforcing bars to the atmosphere with consequent corrosion which can weaken the entire structure. Recent evidence* uncovered at the National Bureau of Standards, however, indicates that these cracks are narrower near the surface of the reinforcing bar than at the outside concrete surface, thus exposing less of the bar to corrosion than was heretofore believed. These measurements, made by D. Watstein and R. G. Mathey of the Bureau's structural engineering laboratory, are expected to be of value to the structural design engineer in making better use of existing design data, with consequent savings in materials.

Conventionally reinforced concrete normally develops numerous fine cracks when the tensil strains caused by loads, drying shrinkage, and thermal changes combine to exceed the limit of extensibility of concrete. Only through careful design and proper selection of well-designed deformed reinforcing bars can the designer limit the width of these cracks to safeguard the steel bars against corrosion. It had been previously believed that the cracks were, on the average, nearly uniform in width from the surface of the concrete to the surface of the bars, and this assumption was followed in designing structures. Since there was indirect evidence that this assumption was not entirely true, the Bureau undertook a more detailed study of the variation of width of cracks.

The crack width measurements were made on tensile bond specimens designed to simulate a portion of the tensile zone of a reinforced concrete beam between two successive cracks. Each specimen was essentially a prism of concrete 8 inches long with a reinforcing bar embedded along the longitudinal axis. A tensile force was applied to the ends of the bar. The extension of the embedded portion of the bar, the over-all extension of the concrete prism at points ⅜ inch from the surface of the bar, and the over-all change in length of the exterior surface of the prism were determined.

Since the length of the exterior surface of concrete remained substantially constant during the test, the over-all extension of the embedded bar was taken as the width of crack measured at the surface of concrete. The difference between the extension of the embedded bar and that of the concrete adjacent to the bar was assumed to give the width of crack at the surface of the bar.

The ratio of the width of crack at the surface of the bar to that at the exterior surface of concrete has been plotted against the applied stress, to provide the engineer with the necessary design information. This reduction of crack width in the vicinity of the surface of reinforcing steel was observed only for deformed bars; no measurable reduction of crack width was observed with smooth round bars.

END

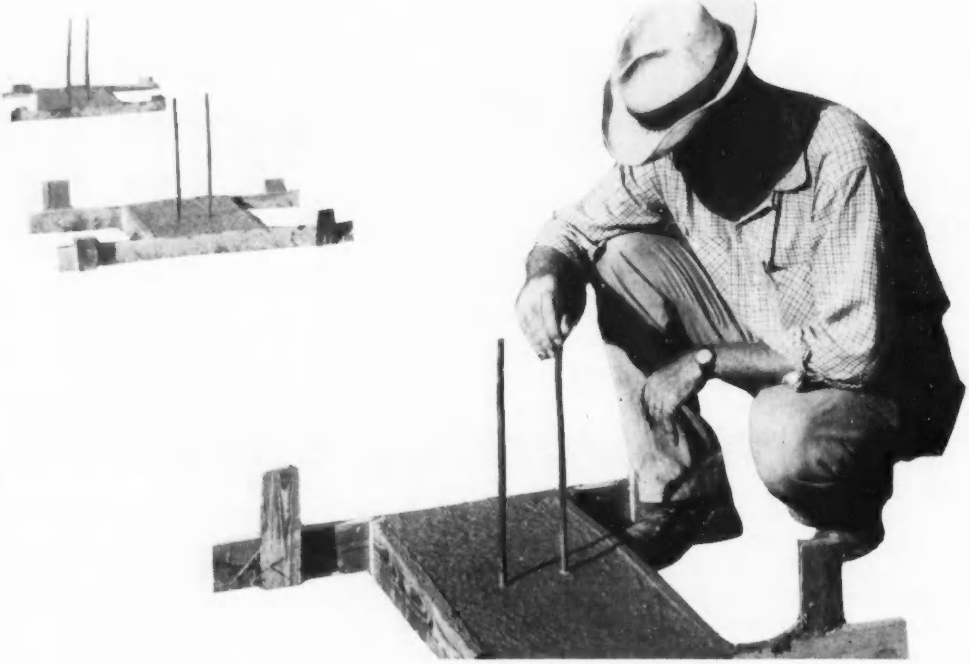
*D. Watstein and R. G. Mathey, Evaluation of width of cracks in concrete at the surface of reinforcing steel by means of tensile bond specimens, RILEM Symposium on Bond and Crack Formation in Reinforced Concrete, Stockholm, 1957.

Readers who would like to have additional information on the subject discussed in the foregoing article may request it by filling out one of the reader service cards in this issue.

FILE: REINFORCEMENT

A College Study Reveals Some New

Tilt-Up Techniques for Small Panels



After determining the building size required, lay out the structure at the desired location. If a floor is needed, pour the slab. Footings should be cast where wall panels are to butt if a dirt floor is to be used. Make sure subsoil conditions are stable enough to preclude any settling.

ALTHOUGH LARGE CONSTRUCTION PROJECTS usually get the lion's share of publicity, small- and medium-sized jobs constitute the bread-and-butter business of most concrete contractors. Recognizing this truism, the Texas Agricultural Experiment Station, in conjunction with the Portland Cement Association, initiated a study to develop economical methods of constructing relatively small buildings. The results were shown at a recent demonstration meeting held at Texas A&M College.

Basically the work had been aimed at devising a simplified tilt-up construction procedure for which unskilled labor could be used on farm projects. No attempt was made to circumvent contractors; care was taken to point out that a qualified contractor should be employed to supervise the construction operations.

The most important step in reducing costs and equipment requirements was the development of a simplified lifting technique. Initially wall panel sizes were examined with an eye to arriving at a versatile and practical module that would be easy to lift. It was found that 8-foot or 10-foot square wall panels would be the right size for more than two-thirds of the building plans for farms.

Accordingly, two buildings (20 by 40 feet and 20 by 60 feet) were built for experimental work. Panels were poured on the floor slab or, lacking this, on a bed of sand. A polyethylene sheet was used to prevent bonding of the panel and the casting bed. Ribbed panels were cast at first but some difficulty was encountered when the work was done by relatively inexperienced workmen. Solid panels were found to be easier to cast and light enough to be handled by common farm machinery. Door and window bucks, together with inserts for the lifting frame, were simply inserted in the forms and secured in place. Panels were cured for three days before being tilted.

At first, panels were tilted with an

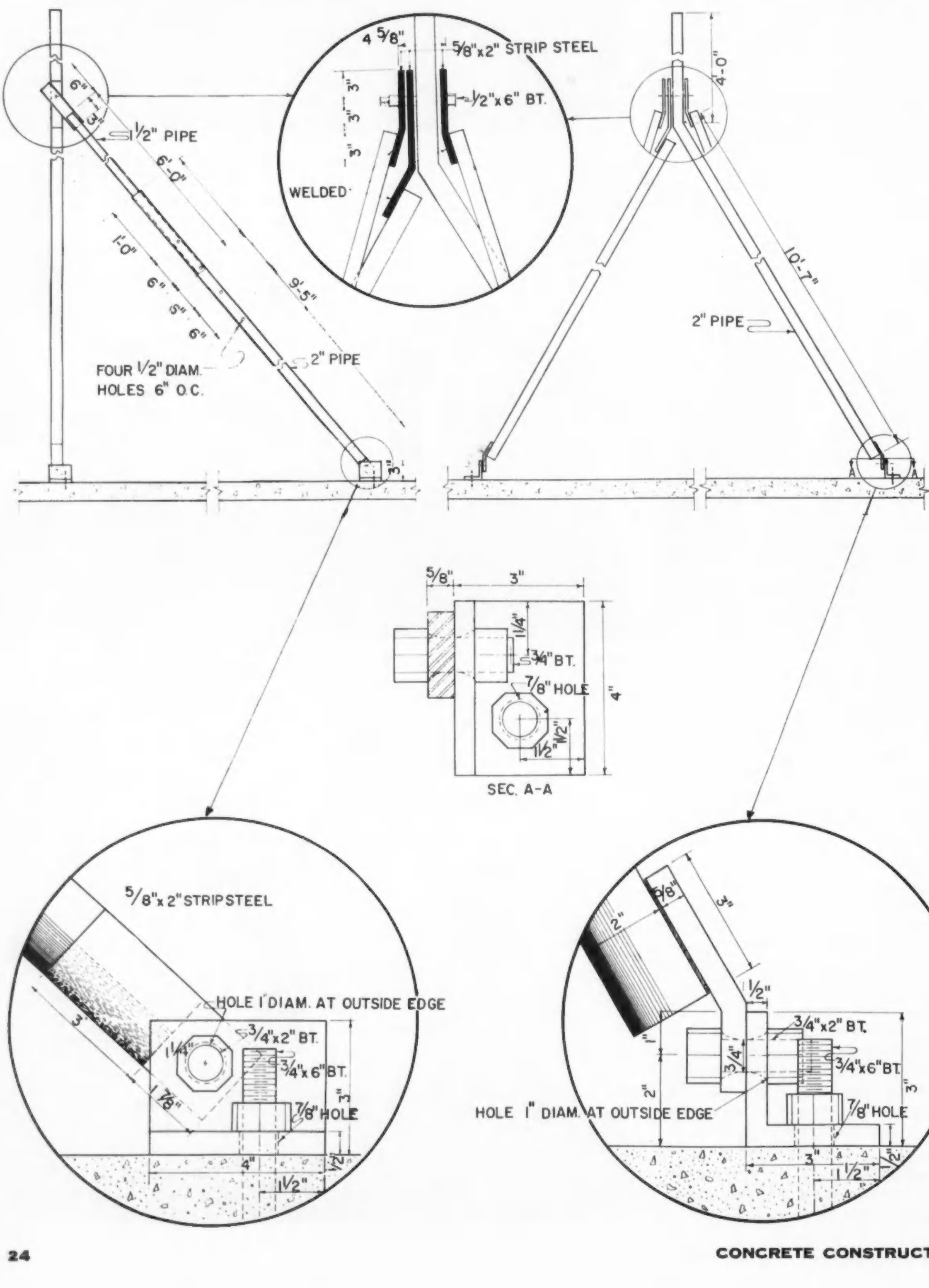
Readers who would like to have additional information on tilt-up construction may request it by filling out one of the reader service cards in this issue.

Build the wall panel forms. They should be adjacent to their final position, if possible, to eliminate any difficulties in moving them horizontally. Provide adequate reinforcing to prevent cracking during the stress of lifting; and securely position inserts and window and door bucks.

Carefully pour the concrete making sure that inserts, bucks and steel are not displaced. A polyethylene sheet between the panel and the floor slab or sand bed will prevent bonding between the two.

Inserts in the panels should be provided to attach the lifting rig. The device pictured proved to work well. It is a pyramidal frame built of 2-inch pipe with its point of hitch 10 feet above the panel. This frame distributes the lifting stresses evenly throughout the concrete.

The drawing below shows some of the details of the tilting frame used for erecting concrete walls panels in the study conducted at the Texas Agricultural Experiment Station. A frame constructed in this manner provides enough leverage for tilting panels up to 10 by 10 feet.



A-frame on a winch truck. Panel damage and handling problems were considerable. After some experimentation a 2-inch pipe pyramidal frame, with the point of hitch 10 feet above the panel face, was found to work well. Two 2-inch diameter roller assemblies were found to be adequate for moving panels horizontally when the panels weigh 4,000 pounds or less. Whenever possible, however, it is advisable to cast the panels so that they can be tilted directly into place.

Once in place, the panels were braced and an H-shaped cast-in-place column connection was poured between adjacent panels. Any kind of roof can be erected on the resulting structure.

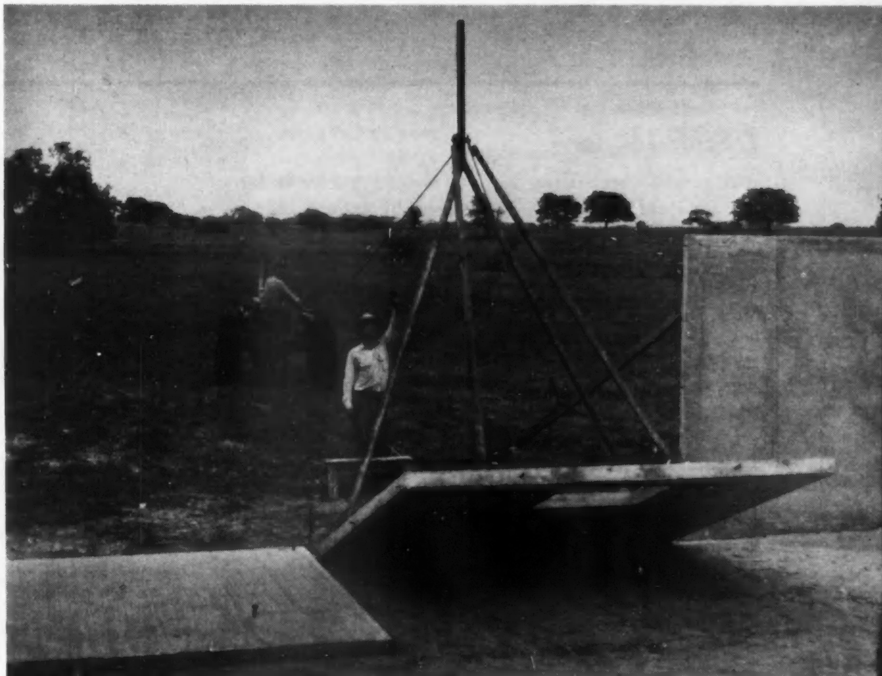
During the construction of these buildings the following observations were made. The largest tractor available should be used to assure a smooth tilting operation. Uneven, jerky tilting results in damaged panels. Concrete should contain six sacks of cement per cubic yard for best results. At least 10-inch square footings should be provided under each panel end. Panels of 4-inch thickness need at least four ⅜-in. reinforcing bars for vertical tension, two in compression, and in addition a horizontal bar in tension at the bottom and the top of the panel. Large panels and those with openings need more steel. Every piece of steel should span the entire panel. Leave one side edge of every panel unbonded with the column connection to allow for thermal movement.

These experimental buildings demonstrated the considerable cost savings possible with tilt-up construction. Texas A & M has accumulated the following cost data for a 60-foot long, 8-foot side wall animal shelter with an open front and an earth floor; cost per square foot for a 20-foot wide unit, $1.18 in pole frame, $1.66 in steel, and $1.24 in tilt-up; cost per square foot for a 30-foot wide unit, $1.00 in pole frame, $1.58 in steel, and $1.07 in tilt-up.

Cost of the 20- by 40-foot machinery shed with dirt floor (figuring labor at $1.50 per hour) was only $854, and $334 of this amount was for the roof. As one Oklahoma contractor put it, "This will be a real boon to our farm customers. When you've lost your buildings to fire, you're easy to sell on concrete. And this is the easiest way to handle concrete I've ever seen."

END

Here the 2-inch pipe pyramidal frame is attached to the panel at all four points, and the actual job of tilting is about to begin. The polyethylene film on which the concrete is placed provides an excellent bond breaker with the subgrade.



A strong cable is then attached to the rig's hitch point and a tractor. The most powerful tractor available should be used to assure a smooth lifting operation. Jerky, uneven lifting results in cracked panels. Once in place, panels should be braced.

BELOW: The 20- by 40-foot machinery shed after completion.

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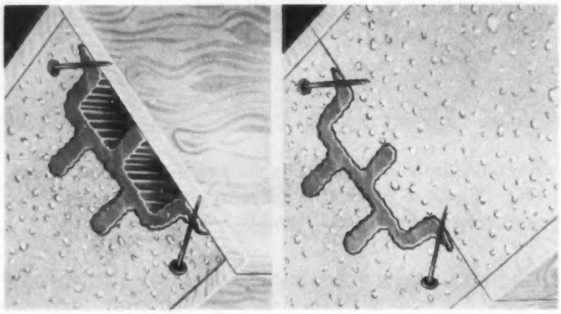
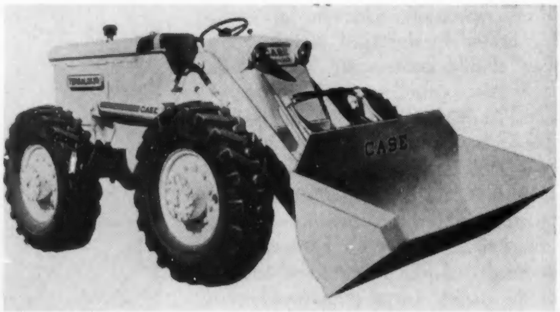


Waterstop

A polyvinyl plastic device is installed by attaching to the inside of the temporary terminal board by driving nails partway in, leaving the heads projecting enough to become embedded in the pour. The flexible, tough plastic allows for expansion and contraction and is resistant to temperature changes, acids and aging. It saves time and money in the construction of sewage treatment plants, tanks, basements, tunnels, water reservoirs, swimming pools, and dams. **Water Seals, Inc., 9 South Clinton Street, Chicago 6, Illinois.**

Tractor-Loader

A new 4-wheel drive, rear-wheel steer tractor-loader in the 1¾-cubic yard class is powered by a Case industrial engine, has 11,000 pounds breakout force at ground level, and 5500-pound lift capacity. Outstanding advancements in operation and safety include rigid lift-arms pivoted forward of the operator's seat, improved stability, power shift and steer, Torqmatic drive, speeds to 21 mph in both forward and reverse, with controls and color-coded instruments designed for easier, faster operation. **J. I. Case Company, Racine, Wisconsin.**

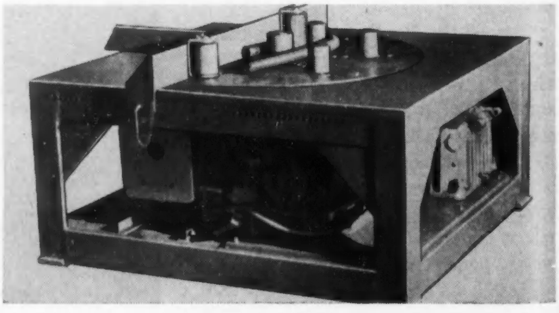


Perimeter Insulation

Gold Bond Thermo-Bloc perimeter insulation applied to the bottom and edges of concrete slab or to the inside of foundation walls effectively reduces heat transfer at these points to a minimum. This permanent heat barrier saves the builder about 25 percent of material cost by eliminating the need for paper or asphaltic coatings. It is non-capillary and will not absorb wet concrete and solidify. It is available in 4-foot lengths of various widths and is easily cut. **National Gypsum Company, Buffalo 2, New York.**

Bar Bender

Modern big project construction requires speed, strength and ruggedness in bending apparatus. This heavy duty bending machine, a simplified, flush-table type, is designed to fill this requirement. It will make any kind of bend, except radial bends, in reinforcing steel of any size up to No. 9 bar. Design simplicity promotes easier operation and reduced maintenance. It is operated by a 20 HP motor, weighs 7,400 pounds and measures 6 by 6½ feet, with 30-inch table height. **Monarch Forge & Machine Works, Inc., 2130 N. W. York Street, Portland, Oregon.**



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Pour Faster

With line-up rails in place (they slip over tops of panels to insure accurate alignment) and with grades set, you can pour an 8' wall in a 120' foundation in *less than 2 hours.* Pour at one corner or four corners simultaneously.

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Stripping a 120' foundation requires less than 3 man hours. After quick break-off of Simplex tie-wires, panels are unlocked easily, then swiftly removed. Workmen appreciate Simplex light weight (an 8' panel weighs only 65 pounds) as panels can be moved speedily with less effort.

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Rugged 1⅛" panels are accurately cut and drilled, with precision-made hardware firmly bolted in place. The combination of the metal backing bar and patented Simplex locking lever *insures positive alignment . . . minimizes seam marks . . . gives a clean, professional job you can show with pride.*

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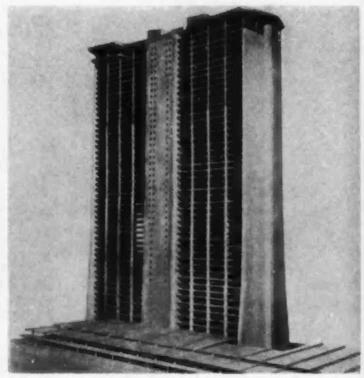
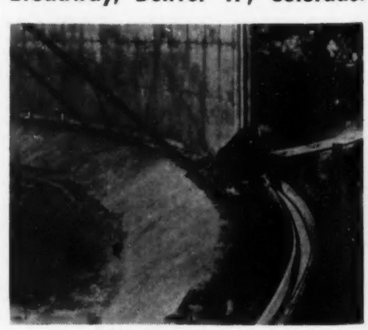
Horizontal Shoring

Spanall all-steel horizontal shoring is being used in forming floors in the world's tallest reinforced concrete building, University City Institute in Caracas, Venezuela. This shoring for beam and slab concrete deck and floor forms is quickly installed and stripped. It provides free work space below formwork. **Spanall of the Americas, Inc., 787 United Nations Plaza, New York 17, New York.**



Prestressed Reservoir

Prestressing, and the use of rubber seals for joints, are among the noteworthy features of a 3-million gallon concrete reservoir recently completed near Los Angeles. Individual wall sections were first poured on top of a ring of rubber stripping, then pulled together and prestressed with over 120 miles of high-tensile steel wire. **The Gates Rubber Company, 999 South Broadway, Denver 17, Colorado.**

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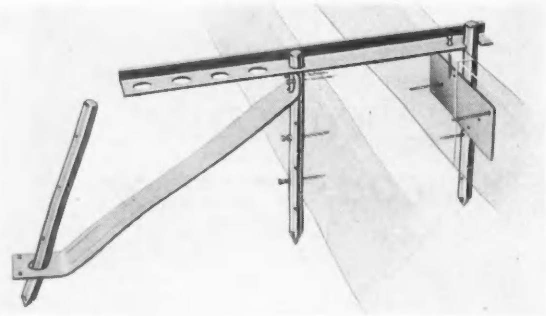
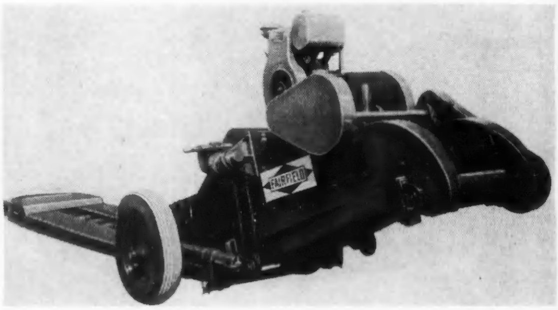


Concrete Form Stake Package

A combination of items revolving around a solid round steel stake, with nail holes in a spiral arrangement, offers the concrete contractor an economical means of staking and bracing low forming. The combination of the steel stake, steel spreader bar, steel brace and form joiner plate permits form setting 5 to 10 times faster than with wood, there is no material clean-up after stripping, and all items can be used repeatedly with continuing savings in material and labor. **Dee Concrete Products Co., 670 N. Michigan Avenue, Chicago 11, Ill.**

Car Unloader

This car unloader can be used as an over-the-rail type unloader or it can be used in a standard pit, making it extremely adaptable to ready-mix operations for unloading bulk materials onto stock-piling conveyors. It is powered with either electric motor or gasoline engine. A tow hitch is provided. The combination belt and chain provide positive, non-slip operation at capacities up to 185 tons per hour. Overall dimensions are 20 feet 10½ inches by 33½ inches. **The Fairfield Engineering Company, Marion, Ohio.**

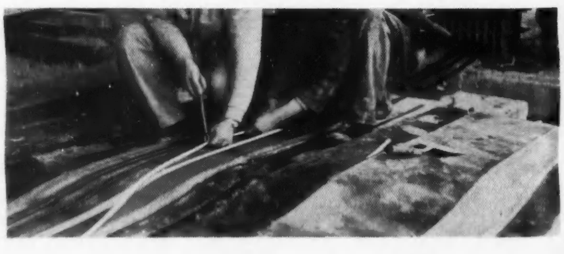


Mobile Construction Building

Ideal for field office, storage or temporary housing, tool shed or workshop, the Economy Mobile Construction Building is a rigid, factory-constructed, 7½ by 16-foot building designed to answer the contractor's demand for mobility from job to job. It is built of kiln-dried, tongue and groove lumber and mounted on a heavy-duty steel undercarriage. The trailer is equipped with tires and electric brakes controlled by the driver. The building is demountable from carriage or is available without undercarriage, complete with floor. **Economy Buildings, Inc., West Chicago, Illinois.**

Bond Prevention in Prestressing

The photograph shows application of Aeroflex plastic tubing for bond prevention over prestressing stands. Desired stress distribution pattern in beam is obtained by partial covering of several strand sections as shown in picture of partially completed beam. Aeroflex tubes can be seen at left end of beam. The tubing is easily applied over the strands by opening it and walking along the strand while pushing the opened tube against the wire. It is self-closing around the strand. **Anchor Plastics Company, 36-36 36th Street, Long Island City 6, New York.**



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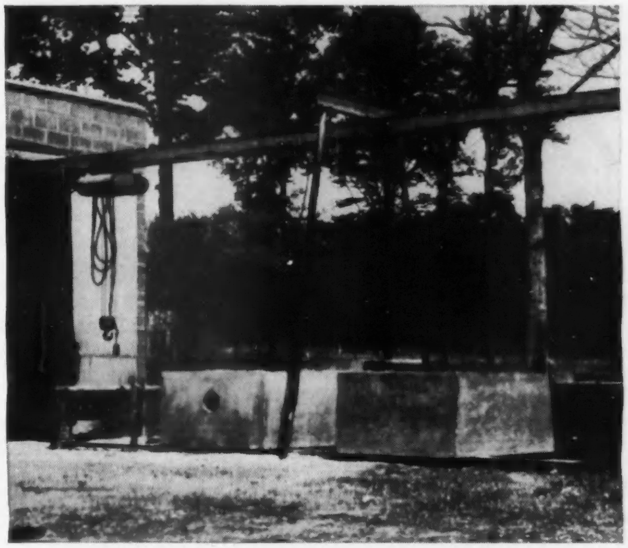

Columbia Calcium Chloride works equally well in concrete made with normal, air entrained, or high early cements.

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Night temperatures lower than 70°F may make your customers turn up their collars, but the chill doesn't slow their jobs when you've treated your ready mix with Columbia Calcium Chloride. Treated concrete sets and strengthens much faster at lower temperatures than you'd ever expect, due to Columbia Calcium Chloride's unique action. Your customers' time-tight jobs benefit because this improved mix gives both initial and final set *three times as fast* as untreated ready mix. And how about this: early strength is 50% greater at 72 hours; ultimate strength tests higher, too. All this means earlier form removal, faster finishing, quicker job wind-up. Have *your* customers been getting these money-saving advantages?

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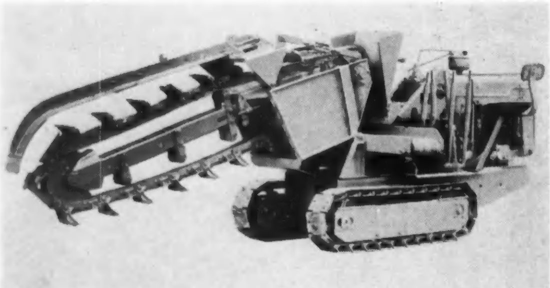

Trencher

The digging range of this compact, 6750-pound trencher is to 5-foot depths at 6- to 18-inch widths. Sixteen digging feeds, from 4.4 to 181 inches per minute, are available. There are four bucket line speeds, and four conveyor belt speeds. The conveyor is shiftable and reversible so spoil can be deposited on either side of the trench. Boom is telescopic for depth variation. The bucket line is self-cleaning. Traction and steering are handled through multiple disc friction clutches. **Parsons Company, Division of Koehring Company, Newton, Iowa.**

Bonding Agent

A new concrete ramp, 0 to 4 inches thick, was poured on old concrete floor over Zack-O-Mix, making a bond that withstands freezing and thawing, without chipping old concrete for feather edge. This material will repair wall cracks, moisture-proof basements, repair broken concrete, bond new floor topping to old floors, and coat surfaces against damage from acids or ice-removing chemicals. Tests indicate that this product halts capillary action, providing excellent moisture proofing. **Concrete Weld Company, Flint, Michigan.**

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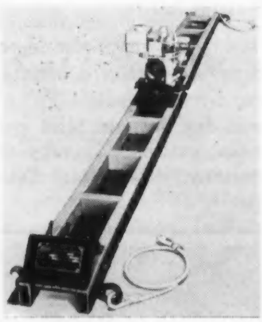
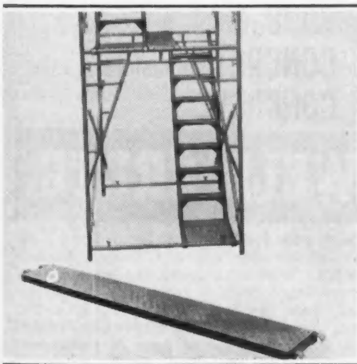


Vibratory Screed

A new double-action vibratory finishing screed vibrates, compacts and levels concrete through a high-frequency slapping action. A gasoline engine actuates a series of steel straps between two beams, delivering the slapping action on the surface of the slab to force out water and air rapidly so that final power trowelling can be started quickly. Available in 7-, 10-, 13- and 16-foot lengths. **Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.**

Power Trowel

Four reversible float blades, adjustable and weighing only 150 pounds, are features of this easy-to-handle 42-inch power trowel. Blades stop rotating when the operator lets go of the handle. A stationary guard ring makes it possible to work up to walls. The engine can be started at full throttle. **Stow Manufacturing Company, 443 State Street, Binghamton, New York.**

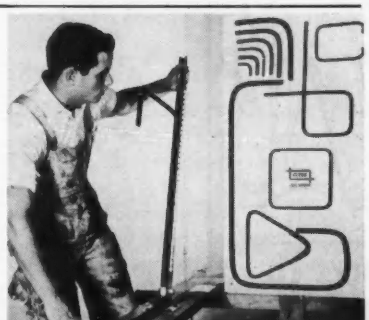


Plank and Stairway Unit

A heavy-duty plank and packaged stairway unit, both designed for use with this manufacturer's sectional steel scaffolding, provide outside access to top additions to buildings and to high bridge construction. Planks are suited for use with rolling scaffolds, with stairways in stair towers, and as planking on scaffolds 3 or more frames long. **The Patent Scaffolding Company, Inc., Long Island City, New York.**

Bar Bender

Designed for the small contractor who must eliminate the expense of having prebent steel delivered, the Clyde Steel Bender shapes 1/4 to 3/4-inch reinforcing steel to any form. It can be adjusted to produce a series of identical shapes. It can be carried in a car trunk and set up on job-site in 2 minutes. **Clyde Manufacturing Company, Inc., Bridgeway at Turney Street, Sausalito, California.**



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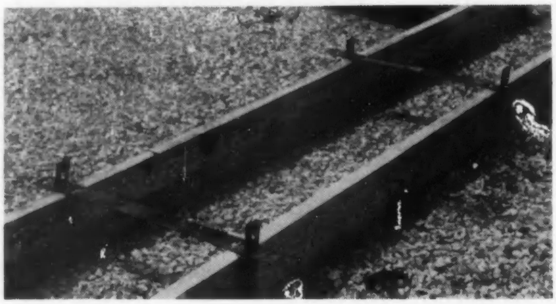

Stake Bar

Shown here is a steel stake bar, for use with the manufacturer's steel stake, which offers six positions for holding steel stakes apart in distances varying in multiples of two inches, from 16 to 24 inches. It is particularly adapted to low wall forming. Its flat surface with nail holes spaced 1-inch apart makes it easy to drive and nail firmly. A pull-out hole at the top permits fast removal with ordinary tools. Both bar and stake are reusable. **Symons Clamp and Manufacturing Company, 4249 West Diversey Avenue, Chicago 39, Illinois.**

Shoring

Only three parts comprise the Brainard Engineering Shoring System. One man can erect a 5-foot square tower quickly, and dismantling for use on the next job is simple. Screw jacks in each foot level the tubular steel frames and equalize the load, and ledger carriers inserted in top members allow the entire load to be borne by leg members. The notched sleeve in each leg permits swift slip-fit and locks one frame with another. A single 8-foot tower will support 28 tons. **Brainard Steel Division, Sharon Steel Corporation, 1313 Jefferson Street, Warren, Ohio.**

equipment tools and materials

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Masonry Drilling Guide

Tough masonry drilling jobs can be made easier by using Tilden Rotary Konkrete Kore drills with the Tilden masonry drill starting guide, which provides a means of precision locating and starting of hole with ease. Guide-holes provide for ¼- through 1¼-inch diameter drills. **Tilden Tool Manufacturing Company, 209 Los Molinos, San Clemente, California.**

For Hoisting Concrete

Mason's mortar pal may be hoisted to pour concrete. Also it may be used to spread sand on finished concrete floors or gravel on roofs. The hoisting arm slips over a scaffold pin, and swings the load on the working area. It is installed and within a few minutes time relocated without the use of tools. **Mason's Pal Products, 509 Thornberry Drive, Evansville, Indiana.**

Mechanical Back-Up Alarm

Bullard Mechanical Vehicle Alarms are self contained and are constructed for use on trucks and fork lift trucks. Easily attached alarms operate independently of electrical circuits or speedometer. Hammers strike bell with the turn of the wheel, when vehicle is in reverse. Rubber cushions eliminate noise in the forward motion. **E. D. Bullard Company, 2680 Bridgeway, Sausalito, California.**

Tamper Attachment

The tamper attachment for the Bantam power cranes-excavators offers 80 to 100 percent compaction at a maximum penetration of 3 feet. Three full-lead passes at a given point in average ground will bring full compaction. The time and labor-saving advantages are apparent. The tamper is interchangeable with any of this manufacturer's other 9 attachments. **Schield Bantam Company, Waverly, Iowa.**

Midget Tractor

A new variation of the Mead Model R-9 midget tractor measures only 28 inches in width to the outer edges of the tracks — 8 inches less than the standard model. This unit has three speeds forward and one reverse, and these are multiplied by the mechanical type of power steering, which has a dual range and neutral position. **Mead Specialties Company, SC-39, 4114 North Knox Avenue, Chicago 41, Illinois.**

Portable Hoisting Machine

The Buck Hoistower is a trailer-mounted unit which is self-erecting to heights of up to 45 feet. Additional tower sections can be added. The concrete bucket assembly allows concrete to be dumped at any height. Fourteen and 17 cubic foot buckets are available. Thirty-five cubic yards of concrete per hour can be poured. **Buck Equipment Corporation, 720 Anderson-Ferry Road, Cincinnati 38, Ohio.**

Metal Surveying Stake

A three-man crew used the Gradline Metal Stake in establishing exact line and grade for forms for five miles of concrete pavement in Washington, with savings in labor time. It can be driven mechanically or by hand, and eliminates cutting off wood stake at specified grade or calculating cut or fill from the top of a hub. **George E. Long Company, 16041 33rd Avenue, N. E., Seattle 55, Washington.**

Level

A new instrument shows exact level points at distances from a few feet to 150 feet. The device has a wide range of uses where the ordinary level is impractical and where it is difficult to establish sight points and recheck elevations with a transit or other instrument. **The Liqui-Level Company, Box 538 Redwood Drive, Felton, California.**

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